Introduction

The Naval Oceanographic Office (NAVOCEANO) Systems Integration Division (N64) has provided on-scene environmental prediction systems for the surface fleet for more than 20 years. From documentation to databases and data processing, NAVOCEANO N64 has served the mission of the warfighter. A key to this success is the development of Web-based applications.

Since its inception, the Geophysics Fleet Mission Program Library (GFMPL) has been the principal software suite used for fleet on-scene environmental predictions. Originally hosted on minicomputers and later personal computers, GFMPL consisted of meteorological, electromagnetic, electro-optical, oceanographic, acoustic and hazard-avoidance software applications. The software applications in the library continue to be used to increase safety for the warfighter and ensure combat effectiveness.

GFMPL

GFMPL was built from algorithms, models and databases from the Oceanographic and Atmospheric Master Library (OAML) established by the Naval Meteorology and Oceanography Command (NMOC). This master repository, of environmental data gathered by NAVOCEANO and computer code developed by research institutions, is the core of Navy environmental predictions. GFMPL has been integrated into other computer hardware and software systems, such as the Navy Integrated Tactical Environmental System (NITES) to maximize utility and meet broader fleet requirements.

Environmental databases and environmental prediction systems must be easily accessible to fleet users through state-of-the-art systems. To meet this challenge, NAVOCEANO has become fully integrated in FORCEnet planning and a full participant in net-centric warfare. Crucial to effectiveness, is the efficient transfer of tactical data and functionality using Web services.

Web services at geographically dispersed locations can be combined to provide users with services from a centralized location. The result is faster, more accurate, more consistent tactical information. GFMPL Web derives much of its data and functionality through a Web service infrastructure. The NAVOCEANO Web Services Working Group (NWSWG) was established in 2003 as the project manager for the creation of Web services for NAVOCEANO environmental databases and environmental prediction systems. When fully implemented, Web-based databases and Web-based applications, such as GFMPL Web will be accessed through the Navy Marine Corps Portal (NMCP).

In the future all Navy and Marine Corps applications will be accessed through the NMCP, and GFMPL Web will be an integral part of the NMCP. The NMCP will allow users to organize applications into customized "workplaces" and will provide a common "look and feel" for various tactical decision aids. Content will be organized into basic functional areas. Applications may be selected individually from hyperlink menus or by dragging and dropping to a workplace.

GFMPL Advantages

The advantages of Web services are many. Access to GFMPL Web is done through the user's Internet browser. The user may take advantage of the greater computing power of the server, which hosts GFMPL Web, and where the actual updates to software, databases and documentation are made. Larger, more dynamic environmental data can be made available to applications via online connectivity. The network employed by Web services can provide the user a much broader perspective of the tactical arena. The most important feature of GFMPL Web will be a reach-back capability for fleet users.

Upon connecting with the GFMPL Web on a secure SIPRNET workstation, the user is presented with a Web-based user interface. Individual applications are accessed through a menu structure of titled tabs and hierarchal hyperlinks. GFMPL Web applications use radio buttons, checkboxes and pull-down menus to quickly enter data, make configurations and generate desired outputs. An important feature is the use of scalable vector graphics (SVG), which provide interactive click-and-drag and zoom in or out capability. Nine software modules currently comprise the GFMPL Web, which are described below.

Map Utility (MAP) – seamlessly integrates with GFMPL Web applications by providing latitude and longitude coordinates and a reference to which output data may be plotted or displayed. The user may pan across the globe using an array of eight direction keys or choose to interactively zoom in or out of the map display. Entering latitude/longitude coordinates centers the geographic display accordingly. MAP is the geographic background and option that first appears to the GFMPL Web user when the connection is made.

Solar/Lunar Almanac Predictions (SLAP) – generates daily/monthly solar/lunar illumination, daily rise/set/transit times and hourly ephemeris data, as well as a Light-Level Planning Calendar (LLPC). GFMPL Web provides output graphs for Solar Daily Illumination (SDI), Lunar Daily Illumination (LDI), Solar Elevation Azimuth Angles (SEAA) and Lunar Elevation Azimuth Angles (LEAA). It also provides a location library in which to save inputs and predictions. A login is required to access the configuration controls.

Tidal Predictions (TIDES) – calculates a time series of daily/hourly tidal heights for specific tidal stations across the world. Latitude and longitude data are accepted with a mouse click in Map display. TIDES output may be selected from stations positioned on the map display with reference and secondary stations shown as display options seen in MAP. TIDES and SLAP applications interact to generate the Astronomical Planning Data, a presentation of sun/moon rise/set times and lunar percent illuminations with a graphical depiction of hourly tide levels superimposed on a day/night/twilight chronological display.

Surf Predictions (SURF) – computes wave height, percent breaking waves and the modified surf index (MSI) for sea and swell waves that move ashore. A graphic display is computed from the entered nearshore depth profiles. SURF provides a table of MSI limits for various landing craft used in amphibious warfare. MSI limits are color-coded with the familiar Go/No-Go (Green/Yellow/Red) criteria. Colors are determined by the computed MSI.

Wind Conversion – provides three-way conversion of true wind, measured (relative or apparent) wind and desired ship's heading/speed. When two of the three aforementioned data sets are entered, the remaining data set is computed. Computation may be done by direct data entry or by clicking and dragging the vertices of the wind triangle in the electronic maneuvering board. Depending on the magnitude of winds and speeds, the maneuvering board can be set to five different scales for size accommodation of the vector graphic. The user may also toggle the maneuvering board grid on and off.

Temperature Utility (Temp Util) – computes the wind chill temperature (WCT), heat stress index (HSI) and wet-bulb global temperature (WBGT) given the following inputs: ambient temperature (T), wind speed (for WCT), pressure for HSI and a moisture parameter for wet bulb temperature (WBT), dew point temperature (DPT) or relative humidity (RH). When one parameter is entered, the other two are computed. A black globe temperature (BGT) is required for WBGT calculation. Temp Util also allows the user to change the system of units employed by the calculation.

Pilot Balloon (PIBAL) – computes a vertical profile of wind direction and speed given the radio telemetry observations of a pilot balloon. PIBAL input includes the angles of elevation and azimuth of the balloon at whole-minute time intervals for three different weights of balloons. Output consists of a tabular listing of the inputs and the wind direction and speed at 300-meter intervals. PIBAL output may be saved for use in other tactical decision aids that require wind directions and speeds for input.

Pressure Altitude/Density Altitude (PADA) – computes the following parameters: sea level pressure (SLP), altimeter setting (ALSTG), pressure altitude (PA), density altitude (DA) and the standard atmosphere based on the upper/lower station pressure and the following optional data fields: station elevation (for ALSTG, PA, DA), 12-hour mean temperature (for SLP), temperature (for DA) and dew point for DA. PADA replaces the calculator wheel once used by fleet aerographers.

Unit Conversion Utility – consists of 47 electronic conversions in seven categories useful for forecasting, acoustics and nautical science. Categories are angle, density, distance, pressure, speed, temperature and time.

GFMPL Web has extensive online user documentation in the form of HTML Help. Web connectivity opens up many possibilities in the area of guidance and instruction. GFMPL Web text and images are easily captured for briefing support, using the inherent features of the Internet browser. Hardcopy printouts from GFMPL Web are obtained through the browser or with Windows functionality.

Future Enhancements

A number of enhancements are planned for GFMPL Web. SLAP will eventually be executed for saved plan of intended movement (PIM) tracks identified in MAP. SURF will access sea and swell inputs from the simulated waves nearshore (SWAN) wave model, surface wind data from the Navy Operational Global Atmospheric Prediction System (NOGAPS) database and depth profiles from a Web-based Hydrographic Reconnaissance Charts (HRC) library. The TIDES application will have additional tide stations from which to perform calculations.

PIBAL will include PILOT, PILOT SHIP and PILOT MOBIL messages as output options. Upgrades to the Briefing Support module are being investigated that will allow users to broadcast GFMPL output on the Web itself. With this webcasting feature, GFMPL Web will not only reach back but will also reach out to all users who require environmental predictions. Current development is underway for the future NMOC Enterprise portal.

In the future Sailors and Marines will access all meteorology and oceanography (METOC) support products, including GFMPL Web, at a single location on the Web. Currently, GFMPL Web may be accessed on the Navy Enterprise Portal or directly on the NAVOCEANO server at https://www.navo.navy.smil.mil/. Search for "GFMPL" in the Quick Search and then select the "GFMPL Web" radio button. GFMPL Web may also be used in a stand-alone mode for users, such as the Mobile Environmental Team offices, who must operate independently of the Internet. Plans are for the GFMPL Web Stand-alone to be downloaded from the GFMPL Web site or delivered on a CD-ROM by request.

GFMPL Web applications were successfully used in Trident Warrior 2004 (TW04), when net-centric warfare operations were put into practice. NAVOCEANO N64 supported the software training efforts of Space and Naval Warfare Systems Command (SPAWAR) personnel during TW04. It is from such exercises as Trident Warrior and the recommendations of forward-deployed units that vital software requirements are elicited. With fleet support, GFMPL Web will become indispensable in serving today's surface warfighter.

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